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ABSTRACT

This unit is intended to teach about scarce resources and to relate them to basic economics and energy conservation. The content and activities of the unit are introduced through conversation and readings flexible enough for free student expression. The purpose of the study is to provide students with enough information about present and emerging sources of energy to enable them to analyze the problems, make some decisions at their own different levels of ability, and motivate them to become energy conservation activists. The unit is divided into four sessions. Background material is provided for each session and activities are suggested. (RH)

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ERNIE ERG'S SECOND PRIMER

on

the economics of the energy crisis

SE 021 781

ERNIE ERG'S SECOND PRIMER ON THE ECONOMICS OF THE ENERGY CRISIS

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Ernie Erg's Second Primer is a unit intended to teach about scarce resources and relate them to basic economics and energy conservation.

prepared by

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and

Environmental and Conservation Office, Arkansas Department of Education

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ERNIE ERG'S SECOND PRIMER ON ENERGY

Ernie Erg's First Primer was a study of the Energy Crisis caused by the oil embargo which was an order by the middle East oil producing companies, prohibiting shipment of oil to the United States.

The energy crisis did not actually begin then. It started when cheap petroleum began to replace slave labor, share croppers and labor intensive manufacturing, and it did not stop with the lifting of the oil embargo.

This unit is not intended to be an all inclusive study of energy. It should build a base upon which future study can expand. It is intended to evoke thinking on such questions as these:

--is the energy problem we face one of the excessive consumer demand or altogether one of diminishing supply?

--how can we move closer to an economic and social system in which economic growth, ethical behavior and aesthetic satisfaction are more nearly in balance.

In the meantime the immediate input students can make as they pursue these questions is through awareness and understanding of energy and the need for it.

"Our language, our learning and as a result our way of thinking about everything - all are couched in terms of "things" and "money" through the systems of men - and - nature, and it is energy that determines all intrinsic value. Until now energy has been wrongly perceived as a commodity, to be mined or stripped, processed, delivered and used. Nature is never compensated for her free gift and we add insult to the economic energy error by throwing the wastes of used energy back in natures face. We have to learn to figure in the costs of making our energy meal, eating it and cleaning up the mess afterwards." [1]Jean Matthews, Office of Chief Scientists, National Park Services.

ERNIE ERG'S SECOND PRIMER goes back to the beginning use of fossil fuels, expands on their circuitous route from where nature left them to the light, heat and motion we've grown accustomed to in our own homes, and takes a quick glance at what may be the fuels of the future.

The characters are the same with one addition and a change in teachers. Grandfather is still with us. The students are a year older and a grade higher.

The assumptions upon which this study is based are:

--fossil fuels are running out. They are not replaceable.

--developing energy alternatives is an imperative, but the process is expensive and will take time.

--the need for ethical behavior, aesthetic satisfaction and conservation will not end with a new source of energy.

--energy is the underlying force in economic growth.

--economic growth is important to us as a means to an end.

--energy conservation practices need not lower the quality of living.

The content and activities of the unit are introduced through conversation and readings flexible enough for free student expression. The purpose of the study is to provide students with enough information about present and emerging sources of energy to enable them to analyze the problems, and make some decisions at their own different levels of ability, and motivate them to become energy conservation activists.

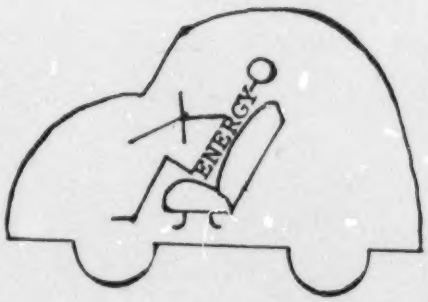
The unit is divided into four sessions. The length of time spent on each session is the decision of the teacher and students. It is expected that this unit of study will be phased into the regular curriculum.

SESSION I - ENERGY

Ramsay: Here's a riddle, Andy. See if you can figure it out.

ONCE A SLAVE: NOW A MASTER.

ONCE BELIEVED TO BE INFINITE: NOW FINITE.



Andy: One thing it is not. It's not a very good riddle. Even a third grader would know that. It's energy of course.

Ramsay: But what's energy?

Andy: Didn't you read Ernie Erg? Energy is the capacity for work. As one of those examples you are always using, it is the capacity to put an automobile in motion, provide light or heat. Do you know what energy power is?

Ramsay: Are you crazy? It's the Zoom! Zoom! - the Zip! Zip! It's the how fast that automobile will go.

Andy: That's not right. It's the rate at which energy is used. I mean the speed of that little hot rod you want depends on the amount of energy it uses. I said uses, not wastes. It probably wastes more than it uses.

Ramsay: Where does energy come from? You wouldn't know. We'd better go ask Mrs. Gray about that. Run! Here comes that third grader. She'll want to tell us about animate and inanimate energy. She's just learned about that. **********

Mrs. Gray: I don't have time this minute, boys. I'll give you this paper on energy to read and we'll talk about it later.

Andy: (reading) The fossil fuels and nuclear energy are stored or potential forms of energy. We can use them whenever we need them.

THE FIVE PRIMARY SOURCES OF ENERGY ARE SOLAR - FOSSIL (oil, gas, coal) NUCLEAR, GEOTHERMAL AND TIDAL.

The other three, solar, geothermal and tidal are kinetic forms

of energy. That means they are always in motion. Until we find some way to harness them, they can be used only when nature makes them available.

Ramsay: That's like old Dave's mustang. He makes you a good, strong saddle horse if you can ever catch him. Andy, is electricity a source of energy?

Andy: Didn't you read Ernie Erg? Electricity is a form of energy. It can be created from all kinds of things - all fossil fuels, water power, chemical reactions, nuclear fission, the wind and the sun, and maybe sometime it will be created from sewage and garbage. Electricity is one of the most useful and widely used forms of energy.

Andy: (reading) Energies now in their early stages of use are solar energy, derived from the sun; geothermal steam or hot water, extracted from the earth's interior; and nuclear energy, stored in the atoms in uranium.

ACTIVITIES:

Start a continuing energy vocabulary.

Select, by student choice, five committees to research the five Primary Sources of energy. Share the reports and elicit contributions, questions, and opinions from the class. Make sure the class understands the difference between value judgement opinions and opinions arrived at after getting as many documented facts as possible.

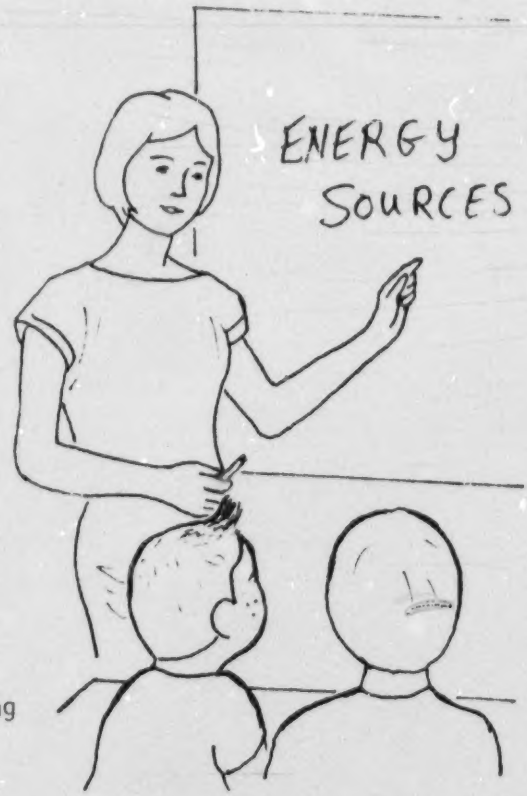
Get indications from students that they understand energy conversion by letting them list objects in the home, school or community. Name the energy used in conversion and the end product.

As a starter, object, a pair of skates; energy, muscle; end product, motion; another - object, an oven; energy, electricity; end product, heat.

SESSION II - RECOVERY AND TRANSPORTATION OF ENERGY

Andy: Mrs. Gray, we know America is an energy intensive society. Where does it get its energy?

Mrs. Gray: The five Primary Sources of energy are gifts of nature. Some of them are stored underground; some above ground; some are tamed; some are still not harnessed. Wherever they are, great amounts of investment capital, (money spent on actual production activities such as construction of new capital projects, tools, training and plants), and human resources have to be used in extracting, processing, transporting and marketing before they are energy converters ready for use.



Here is something you can look at. This might answer some of your questions.

WHERE DOES AMERICA GET ITS ENERGY?

Oil	46%	Water Power	4%
Gas	32%	Nuclear Power	1%
Coal	17%		

Millions of years ago plants lived and died in forests and swamps which covered parts of the earth. New plants grew and died on top of the layers, and this chain of growth and decay formed a rich, soft material which has been likened to rotten wood.

Over millions of years the earth's surface, sand, and water from the oceans rolled over the layers of rotting vegetation. The pressure and weight of the water plus heat and bacteria changed the rotting plants into fossil fuels - coal, oil and natural gas.

One of the most important fossil fuels is petroleum or crude oil, a thick brownish to clear liquid. Oil is trapped in porous rock beneath the surface of the earth. To find it we sometimes have to drill thousands of feet. After it is mined, it is piped to a refinery where it is changed into different oil products. Every day we use products made from petroleum. In fact, most of the energy we use today comes from oil. Some of the uses are for space heating, gasoline, motor oil for transportation; kerosene for jet aircraft; diesel fuel for trucks; machinery, and asphalt for road building.

It is also used as a raw material, (one of the resources of production that has been converted from its natural state to a state where it can be used in the production of a consumer good or service), in the production of plastic packaging, furniture, synthetic rubber and man made fabrics such as nylon and even some medicine. Review *ERNIE ERG'S FIRST PRIMER*, pg. 8 or *ECONOMIC EDUCATION FOR ARKANSAS ELEMENTARY SCHOOLS*, Area III, pp. 65-96 for more information about productive resources.

Natural gas, an airlike substance, is the cleanest burning of the fossil fuels and the most convenient to produce and use, but the methods of recovering it are sometimes so expensive that the recovery or "lifting" uses more energy than is produced. This statement introduces a new word for your vocabulary

list, *net energy*. It is the difference between the energy used in the recovery of an amount of energy and the amount of conversion energy recovered.

A hole is drilled and pumps are used to move gas along pipe lines. It can be stored underground in tanks until it is needed.

Coal is our nations most abundant fossil fuel. It is used to generate electricity in industries such as steel; for space heating and in many other ways.

Two methods of mining coal are practiced - strip or surface mining and deep or underground mining. Coal mining is considered one of the most dangerous occupations in the country. It also takes a heavy toll on the environment.

Energy is transported in different ways: oil and gas by pipeline; supertankers and the Alaska pipline are new ways of shipping oil long distance; coal goes by rail; and electricity by high voltage wires that you see strung overhead.

Both the money cost and the cost to the environment must be figured in the total cost of energy. The more energy we use, the more we pollute the environment; the more we pollute the more energy we use in cleaning it up.

Early types of energy were:

MUSCLE: produced directly by people and animals.

WATER: falls turned wheels.

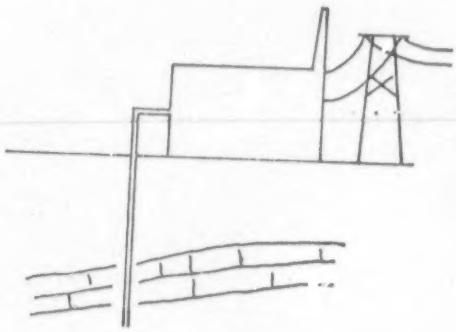
WIND: Windmills pumped water, sawed wood, lifted weights and generated electricity until cheap fossil fuel replaced them.

WOOD: converted into heat.

Did you know that from 1880 to 1930, over 6 million windmills generated electric power in the west until cheap fuels were found to be better?

Energies of the future have not been used extensively enough in this country to merit actual evaluation.

GEOTHERMAL energy is extracted from the earth's interior in the form of steam or hot water. Bore holes are drilled in the earth near hot springs. Hot water or steam is pumped to storage tanks and pumping stations and then to consumer.



SOLAR AND NUCLEAR energies are found above ground.

Nuclear energy is stored in atoms in uranium. Nuclear power plants have been designed to take advantage of this uranium fueled source. Controversy whirls around its use. It has not been fully accepted. Indications are that, in the face of our increasing need for electricity and the dwindling of our fossil fuels, it will be used in increasing amounts if the anxieties its use creates can be relieved.

Solar energy is not new to us. It is our major source of energy. We know that it gives us energy as light; that it is absorbed and used by plants to manufacture foods, and it gives us heat which we are just now beginning to harness.

Solar energy can be directly converted to heat. The heat is transferred to air or water which is then circulated to a container where the heat can be stored or used.

For understandable reasons, people seem to have less apprehension about solar energy use than some of the other emerging sources. Probably, because we have always depended upon the sun for so many other ways of satisfying our needs.

It is now believed that if we use resources conservatively, the world has the potential to continue to supply itself with fossil fuels until it is technically and economically able to shift to some of the other types of energy.

ACTIVITIES:

Make a drawing tracing the chain of events anyone of the forms of energy (fossil fuels) goes through from its natural state to the work it does for us. As an example, coal is extracted from the ground. Coal stores chemical energy. Coal can be burned to make heat energy. Heat can run a generator to make electrical energy. The electricity passes over wires to run a motor and the motor can run your washing machine.

Some people think we should have been storing our own gas and importing gas for present use so we would not have been unprepared for the embargo. What do you think? Maybe students would like to debate this.

Describe the continuing controversy between environmentalists and coal entrepreneurs (entrepreneurs bring together productive resources and organize them for production). One side speaks from the viewpoint of the need for abundant supply of fuel for production of consumer goods and services and the other from the viewpoint that ethical and aesthetic values should not be lost to excessive demand.

Make a date line showing new sources of energy in historical sequence. List new capital tools and some changes in production practices that emerged with development of each new source of energy. Illustrate modes of travel changes with each new energy. Invite an "oldtimer" to come in and talk about this.

Name ways energy can be used to beautify home environment.

Where in the United States is geothermal energy being used in production? Where outside of the United States is it being used extensively?

Demonstrate the effect of concentrating solar energy with a magnifying glass by igniting paper.

Make your own priority list of how energy producing fuel should be used if we actually faced an extreme fuel shortage.

Encourage students to bring to class newspaper and magazine articles dealing with the whole area of energy. List some environmental effects of producing and using oil. Describe some specific examples. Does this mean we should stop using oil? What does it mean?

SESSION III - YOU CAN HELP TO CONSERVE ENERGY

Andy: *Would you burn money to heat your home?*

Ramsay: *Of course not.*

Andy: *But that's just what you are doing.*

Ramsay: Mrs. Gray, at our age, we don't have much to say about how energy is used or what it costs or how much is wasted. Why do we have to spend all this time studying about it?

Mrs. Gray: Well, there is something you should learn right now and that is the meaning of Opportunity Cost. You'll understand then why saving energy is some of your business. Somebody in your family has to pay the utility bills, which means the bills for the light, heat, and the electricity that passes over the wires that run the motors of your vacuum cleaner, your washing machines, refrigerator, dish-washer, egg beater, blender, typewriter and all other electric appliances that do the work. Otherwise, the work would have to be

done with muscle power, maybe your own. The more you run the motors that work for you or use the lights and heat, the higher your utility bills will be. Opportunity Cost means the more you pay for one thing, in this case energy services, the less the family, including you, will have to spend for other things you want, and may even need.

Andy: But, Mrs. Gray, these are uses we have to make of energy. These are things we really need. How could we save on them?

Mrs. Gray: One way is by organization - now, you tell me how you save that way.

Ramsay: Yeah! I get it. Organize the cooking so all of the things that will be needed out of the "frig" can be taken out at the same time and when the meal is over or when groceries are brought in, put everything in the "frig" with one door opening.

Mrs. Gray: The sound you hear when the refrigerator door is opened and closed for every item needed, or left open while you make use of each food is a gleeful tune for Lizzie Electricity. She gets to start dancing again.

Andy: Organize the cooking so all of the food cooked in the oven can be done at the same time. Reheating the oven sometimes takes as much energy as the cooking. We'd have to get the family's cooperation in saving energy this way.

Mrs. Gray: There are other do's and don'ts to energy saving. You call some of them out and I'll write them down.

Did you know that fluorescent lights are 4 times as efficient as incandescent lights?

--Install storm windows and add insulation up to 12" in ceiling and 6" in walls at a savings of up to 50% of home heating energy. If everybody did this, it would reduce our country's energy consumption about 4.6%.

--If you have windows that open top and bottom, open them a little at top and bottom on pleasant days. Top lets hot air out; bottom lets cool air in.

--Read your meters to see how and when you conserve energy. Make a home inventory to locate waste pockets.

Did you know that 50% of the natural gas used in cooking is consumed by pilot lights. They are on all day and night?

--Set thermostat at 78 in summer; 68 in winter. Have a sweater and socks handy to put on instead of changing the thermostat in winter.

--Grow trees to shade your south facing windows and roof. It has been calculated that the solar energy falling on the typical house is nearly 10 x as great as the annual space heat demand of that house. Deciduous trees give shade in summer and permit the sun to warm the house in winter.

--Reflectors, roof overhangs and shutters are all devices that can be used to cover south facing windows. Curtains do a little good by keeping sunlight out of the room, but best results are obtained by preventing the sun from entering the glass of a window.

Did you know that weather stripping can save from 15 to 30% of a home heat budget?

Did you know that a frost free refrigerator uses 50% more energy than a standard one?

HOW TO CONSERVE ENERGY AT SCHOOL

Mrs. Gray: There's not much you can do about school buildings already in existence, but you should be aware that most of them waste as much as 40% of the energy available to them.

A recent study by Educational Facilities Labratory indicates that at least $4000 per year in fuel and utility costs in a typical elementary school can be saved by reducing energy waste; over $10,000 for secondary schools.

--By turning heat on at 7:00 a.m. and turning it off at 3:00 p.m., fuel consumption could be reduced by around 13% annually. In some parts of the country this would be feasible; in others it wouldn't. Why?

--It has been suggested that a one week extension of Christmas vacation would result in a 5.8% fuel decrease in a year. What is your reaction?

--Setting thermostat at 68^{0} instead of 75^{0} in winter could save approximately 23% of the annual heating fuel.

--Light and heat only the areas that are to be used.

--Conduct an energy inventory to see if you can find ways you can save. Saving paper would reduce waste as well as natural resources.

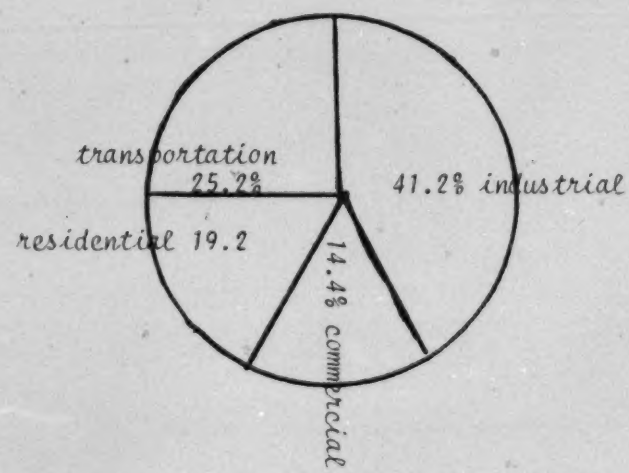
--Send a committee to interview members of the school board to see if they have plans for energy conservation in reconditioning old buildings or including energy conservation saving techniques in any new buildings. If possible, visit a home or school being built to take advantage of solar energy.

Did you know that the overall energy efficiency of the U.S. economy in 1970 was about 31%, meaning that 49% of the 64.6 quadrillion BTU consumed was discarded as waste heat and pollution, doing no useful work?

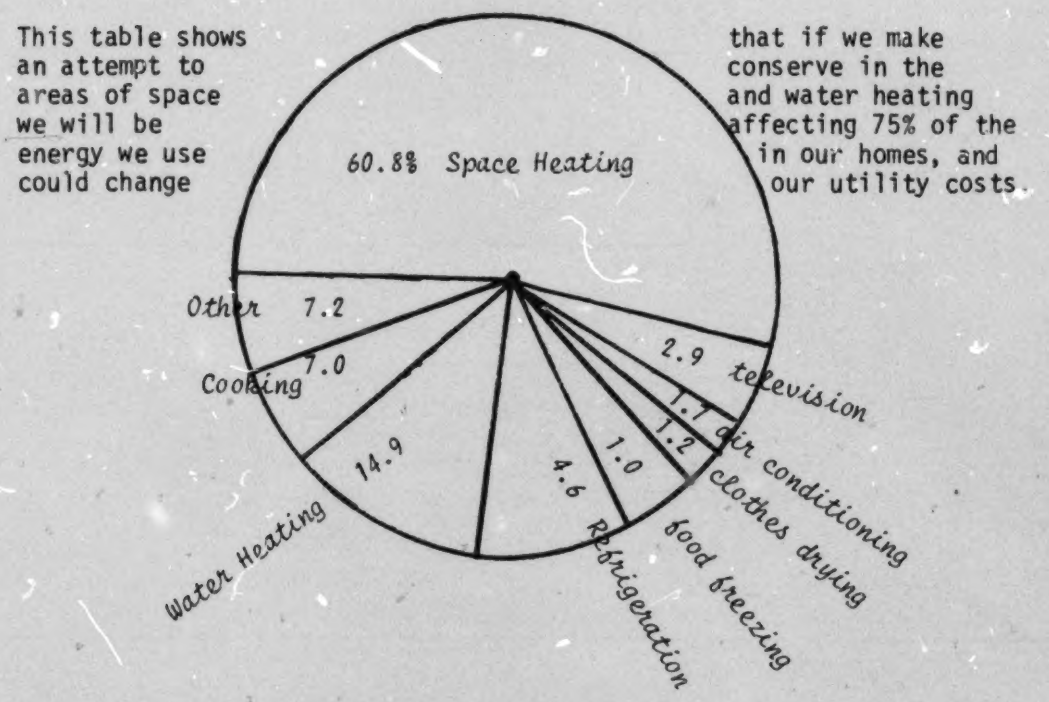
ENERGY EFFICIENCY - energy actually put to work.

A BTU is the amount of energy required to raise the temperature of one pound of water, one degree Farenheit.

Energy consumption by economic sectors →



Some estimated end uses of energy in the residential sector:



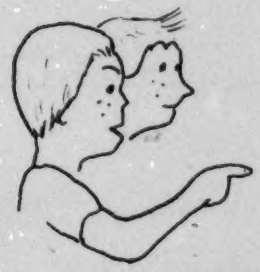
The table points up the need for a timer on the hot water heater and a plan for organizing housekeeping activities so the ones calling for hot water can be done in the same part of the day. It also points out that more than 60% of home energy consumption goes into heating a home. So, lowering the thermostat does make a difference.

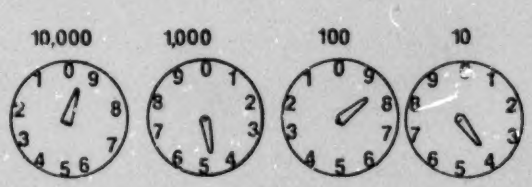
Randy: Mrs. Gray, can you show us how to read an electric meter?

Mrs. Gray: Yes, I can show you, but I would suggest that you find out from your own electric company how they read them. The company will be pleased to cooperate with you in this project. The utility companies will usually send somebody out to your classroom to answer other questions you would like answered.

The measurment of electricity is killowatt hours. (1 killowatt = 1000 watts.) This is the amount of electricity needed to burn

ten 100 watt light bulbs for one hour. (10 bulbs x 100 watts = 1000 watts or 1 killowatt.) Most electric meters have a set of dials which are read in multiples of 10. Most dials read left to right. Read the meter below clockwise. Remember, if the pointer is between two numbers you record the smaller.





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Ramsay: Mrs. Gray, is saving money the only reason why we should conserve energy at home and at school?

Andy: Don't be so stupid, Ramsay. Money's not everything, but I'd sure like to make a few bucks, especially if I could do it by just finding ways to save energy. You see, Ramsay, it's just like the man said. In your home you have to pay for the energy that shows up on the bill anyway, even if the energy was wasted. What Mrs. Gray is trying to tell us is that we wouldn't actually make money; we would save money which is the same thing.

Ramsay: Yeah! I get it. If you want to live in a house overheated in winter to make up for all the ways heat escapes in a household; so cold in summer you have to wear a sweater and sleep under blankets it's OK, but I'm going to start watching all these things we've been talking about. If Dad sees that we are saving him from Ernie Erg's way of heating a house with money, maybe he'll up our allowance.

ACTIVITIES:

Make a brief list of energy saving devices suggested in this session. For example, it would run like this: (1) organization, (2) storm windows and insulation, (3) home energy use inventory, (4) thermostat setting, (5) trees for enhancing house comfort, etc. Place it on the bulletin board. Let students report anyone of these activities they or their family can participate in. Don't let this die. Take a few minutes time for it every day. Awareness is the name of the game. Also, encourage them to come up with other saving devices they have discovered.

Divide students into groups. Ask each group to construct the interior and the immediate environment of what they would call "quality living from a standpoint of keeping energy wastes down."

What were some voluntary and involuntary ways of saving fuel during the oil embargo?

SESSION IV - ENERGY AND THE QUALITY OF ECONOMIC GROWTH

Ramsay: Grandfather, I'm frustrated. We learned in school about productive resources and the large supply of them we have in this country. We also learned that the amount of the Gross National Product, which is the dollar value of goods and services produced in a year, amounted to more than a trillion dollars. I don't know how much a trillion is but it must be big. If we are producing that much, what are we worried about?

Grandfather: As Andy would say, Ramsay, haven't you read Ernie Erg? (a broader

understanding of productive resources can be developed through Area III of the guide, *Economics for Arkansas Elementary Schools*, available to all Arkansas teachers at no cost to them or their school system and *Ernie Erg's First Primer*, pg. 8).

Our country was blessed with an abundance of natural resources; we have the most productive labor force in the world, and accumulated capital, (money that has been saved or borrowed to provide for modern production equipment, such as man-made tools, machines, factories, buildings, dams and other capital goods that do not satisfy consumer wants directly, but are used to produce goods and services we want and need).

Ramsay: Then what's stopping us? Why don't we keep on producing all these things people want.

Grandfather: Because, Ramsay, the rich reservoir of natural resources we inherited from nature cannot, in their natural state, produce anything of material value alone. The machines, electronic devices and capital equipment of all kinds used in converting natural resources to final capacity for production of consumer and capital goods, require inanimate energy to run them. Unfortunately this source of mechanical energy, as it is sometimes called, can only be obtained from the Primary Sources of fuel - coal, oil, or gas which are diminishing or the nuclear, solar and geothermal fuels that are not produced in large quantities.

Review Session II

Ramsay: In Session II, we all got interested in ways of conserving energy in homes and schools. We found ways, not mentioned in our own book, in outside reading. What we are thinking about now is another way of saving energy. We went back to 10 one dollar bills that we laid on the table and worked from there up to a trillion dollars to get some idea of what we were talking about when we talked about the G.N.P. The thing that blew our minds was a look at a per-capita energy use chart that showed the energy use of 33 different countries and the per-capita income of these countries. We could see why production in U.S. was so much higher than even the other largest producing countries. Production depends on energy and United States, with only about 6% of the world's population, uses more than 30% of the presently available energy.

Grandfather: It is easy to visualize the close relation between energy and production when we see that some 500,000 jobs were lost during the oil embargo.

Ramsay: Is this much production really necessary, Grandfather?

Grandfather: Production determines the economic growth of a country, Ramsay, and it is necessary for a country to show a stable increase in production, as long as we have population growth. With population increasing, people have to be fed, clothed and housed. Keep in mind that all jobs and all incomes result from production. You'll see how important this is when you get through school and want a job. Another reason why economic growth is important is that government wealth (local, state and national),

needed for improved health services, public housing, highways and education, comes from taxing and borrowing. A slowdown in growth lowers the amount of tax money spent on these services and puts a heavier burden on private enterprise. Why? Economic growth means the expansion of business; the hiring of new people; the building and renovating of factories, plants, wholesale and retail stores. It means making cars and airplanes; building highways, schools and houses. All of these production activities create new jobs for an increasing population. Without jobs there would be no income to buy all of these goods and services. The trade off here is either decrease population growth rate and maintain our high standard of living, or higher population growth rate and a lowered standard of living.

Ramsay: We need and have an economic system to help us find ways of satisfying people's wants and needs with scarce resources. Right?

Grandfather: About right.

Ramsay: Then some of what we say we are doing is OK. The kind of production we've been talking about does satisfy the needs and wants of people, but do you really think a lot of the junk and stuff we produce is satisfying? Here comes Andy. Let's get him on this.

Grandfather: The thing you are asking, Ramsay, is what most young people and many adults are asking today. Is a growing economy an end within itself? Do we want to be able to keep up our production of so many trillions of dollars worth of something, or do

we want to produce because this much production can be a means of a growing equality of opportunity for material betterment and a rising quality of life?

Critics of the economy, many of them young people, are beginning to agree that too much is spent on extreme luxuries and frivolous consumer goods. The wastefulness we see in energy use clearly indicates we do not yet understand that production of non-satisfying goods and services use the same kind of energy as the production of more satisfying and needed commodities.

Andy: Now here's where we come in. Ramsay, why do you think producers keep producing what you call junk goods?

Ramsay: I guess they want to sell them to earn income.

Andy: If we didn't buy this junk, as you call it, what do you think the producers would do?

Ramsay: They'd probably stop producing these things.

Andy: All right. Whose fault is it then that resources that could be used to feed hungry people, provide beauty and recreation and a good way of life for the mass of people is used for something that, at most, brings only momentary satisfaction and is often discarded before the buyer gets home with it?

Grandfather: Andy's right. We felt a surge of pride when we heard that the G.N.P. would reach a trillion dollars by 1971. If we had some way of measuring the quality of this tremendous output of goods and services we might see that we have been wasting some of our resources to no great benefit to mankind. If this is true, students should understand that we have nobody but ourselves to

blame. What producers will produce is determined by the dollar vote of individual citizens, i.e., when we buy something at the market, we are saying to producers, 'keep producing this good or service". We also have the privilege of expressing through the ballot box what we want from our government.

Andy: Mrs. Gray, what does Opportunity Cost mean?

Mrs. Gray: In simple terms, Andy, it means that time, money and resources spent on one thing can't be spent on another. It's what we give up when we make a choice between two alternatives.

Andy: Then that means the more we spend on commodities that we don't need or especially want, the more we increase solid and ugly waste and the less energy we have to use in beautifying our lakes, rivers, forests, parks, purifying the air we breathe, and still providing satisfying goods and services.

Mrs. Gray: That's about it, Andy. Don't forget our school slogan, "EVERYBODY IS A RESOURCE MANAGER"

ACTIVITY:

If you were asked to list some things that, in your opinion, would enhance the quality of life in this country, what would your list include?

Do you think the quality of life could be made better without slowing production? (The last question is for students. Require them to substantiate their answers).

Test Your E.Q.*

Take this quiz to check your knowledge and understanding of energy-environment issues. When you have marked your answers, turn to the next page to see how well you have done.

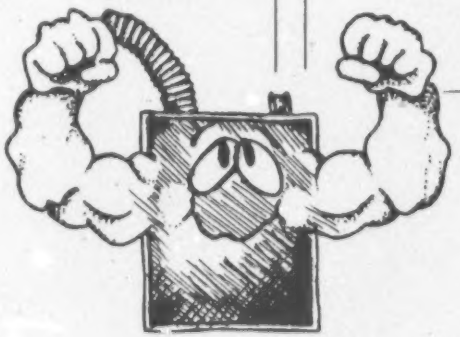
1. —— How much of the energy used in gas stoves supplies the pilot lights?
   a. 10%
   b. 25%
   c. 50%

—— 2. An incandescent lamp and a fluorescent lamp having the same light output: Which uses energy more efficiently?
a. fluorescent
b. incandescent
c. both about the same efficiency

—— 3. How many soft drink cans can be manufactured from recycled aluminum with the energy needed to make a single can from aluminum ore?
a. three
b. five
c. twenty

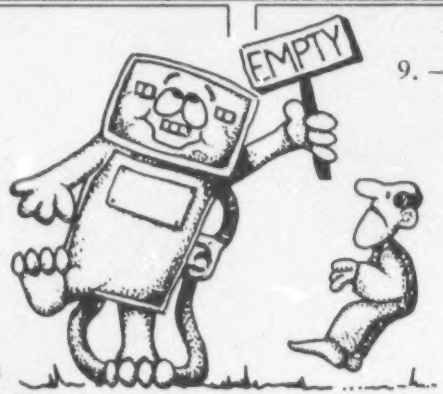
—— 4. How long would a 100-watt light bulb burn on the energy needed to manufacture one throw-away soft-drink can or bottle?
a. 10 minutes
b. 5 hours
c. 20 hours

—— 5. How much of the energy stored in crude petroleum is lost between the oil well and a moving car?
a. 20%
b. 60%
c. 90%



—— 6. The heat energy of a gallon of gasoline is equivalent to
a. 5 man-days of labor
b. 15 man-days of labor
c. 25 man-days of labor

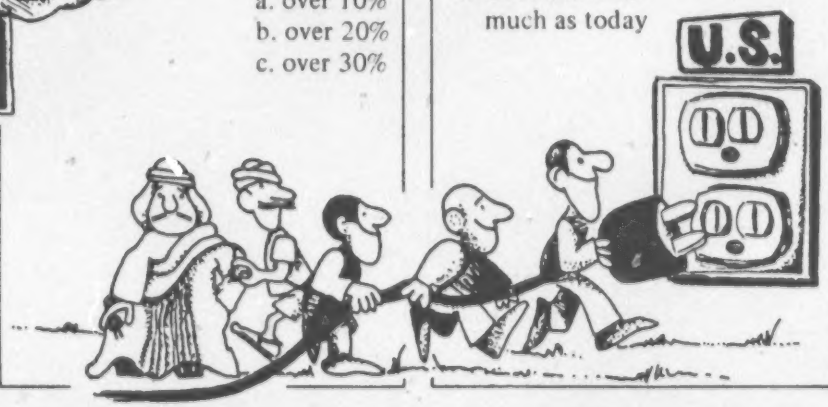
—— 7. How much faster than their rate of production are we consuming our fossil fuels?
a. 10 times
b. 1,000 times
c. 1,000,000 times



—— 8. What fraction of the world's energy consumption occurs in the U. S.?
a. over 10%
b. over 20%
c. over 30%

9. —— Which of the following fuel resources is in greatest danger of exhaustion?
a. coal
b. petroleum
c. natural gas

—— 10. In the year 2000, American total energy demand will be:
a. the same as today
b. twice as much as today
c. three times as much as today



* *Energy Quotient.*

Energy and the Environment, CITIZENS WORKSHOP HANDBOOK, U. S. Government Printing Office: 1975

ANSWERS

Score 1 for each correct answer
0-5 Poor, 6-7 Fair, 8-10 Good

1. (c) Approximately half of the gas used in a gas stove is used to fuel the pilot lights because pilot lights burn continuously.

2. (a) Fluorescent lights give off three to four times as much light per watt of electricity used as incandescent lamps do.

3. (c) Aluminum is a very energy intensive material with the largest share of the energy going to process the ore. Recycling is a great energy saver.

4. (b) A 100-watt lamp could burn for 5 hours on the energy used to manufacture a disposable can or bottle.

5. (c) Ninety-four per cent of the energy in the gasoline from crude petroleum is lost in making your car move.

6. (b) 15 man-days of labor. Said in another way, one barrel of oil contains heat energy equivalent to the energy of a man at hard labor for 2 years.

7. (c) In less than 500 years man will have consumed essentially all of the coal, oil, and gas that nature started forming 500,000,000 years ago. By comparison, that same fraction of a calendar year is approximately 30 seconds.

8. (c) More than a third of the world's energy is consumed by the 6% of the world's population residing in the United States.

9. (c) Natural gas reserves in the U. S. are expected to be exhausted in about 40 years. Petroleum should last for a century. Coal, 500 years or so.

10. (b) For more than a century, American demand for energy has doubled, on the average, every 20-25 years.